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EXAMINER	
FLETCHER III, WILLIAM P	
ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 05/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/739,087	SHAIKH ET AL.	
	Examiner	Art Unit	
	William P. Fletcher III	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 03 March 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-4,6,7 and 20-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-4,6,7 and 20-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 30 January 2003 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Claims 1-4, 6, 7, and 20-24 are pending.

Response to Arguments

2. Applicant's arguments, see the amendment and response, filed 3/3/2004, with respect to the rejection of claim 1 under 35 U.S.C. § 112, 2nd Paragraph, have been fully considered in view of applicant's amendment and are persuasive. This rejection has been withdrawn.

Applicant has not addressed the rejection of claim 22 under this section and the claim remains indefinite for the reasons at pages 4-5 of the Office action mailed 7/21/2003.

3. Applicant's arguments with respect to the newly-claimed aerodynamic focusing feature have been considered but are moot in view of the new ground(s) of rejection set-forth below.

4. Applicant's arguments filed 3/3/2004, with respect to the prior art rejections set-forth in the Office action mailed 7/21/2003, have been fully considered but they are not persuasive.

Applicant argues that Shepard is non-analogous art because "it addresses a different problem than Applicant's invention." In response, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Shepard, like Palazzolo, is drawn to a method for lining cylinder bores utilizing a spray-application process. Consequently, Shepard is analogous art and this argument is not persuasive.

Applicant argues that Marantz does not bring forth a rotatable nozzle as does Applicant's invention. The examiner notes that Marantz is relied upon as providing evidence of and motivation for coating more than one cylinder bore at a time *and* explicitly teaching that a common prior art process for lining cylinder bores involves the rotation of the nozzles (see c. 1). Consequently, this argument is not persuasive.

Applicant argues that certain process parameters of Gorynin teach away from the invention. The examiner notes that Gorynin is cited as providing evidence of and motivation for depositing a graded layer. Consequently, applicant's arguments are not commensurate in scope with the rejections of record and are not persuasive.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. **Claims 1-4, 6, 7, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Palazzolo et al. (US 5,691,004 A) in view of Alkhimov et al. (US 5,302,414 A),**

Brockmann et al. (US 6,348,687 B1), Shepard (US 2,588,422 A), and Marantz et al. (US 5,714,205 A).

With respect to claims 1, 6, and 7, Palazzolo teaches a process of lining a cylinder bore of an aluminum engine block in which the cylinder bore is sprayed with a lining material of various metals that are different from the material of the engine block (abstract). The lining material is applied by thermal spraying (abstract). This thermal spraying is carried-out by a powder plasma spray technique (4:55-56).

Palazzolo does not teach that the lining is applied using an aerodynamically-focused, gas-dynamic cold spray, that the spray comes from rotatable nozzles having unified, up-and-down relative movement with the engine block, that the nozzles are at an angle of 30° plus or minus 15° with a surface of the cylinder bores, or that the cylinder bores are coated in multiple passes.

Alkhimov teaches a gas-dynamic cold spraying process for applying a coating to an article (abstract). This process directs a jet of powder of a metal, alloy, or a mechanical mixture of a metal and an alloy, against an article to deposit the coating (abstract). Alkhimov teaches that this gas-dynamic cold spraying process eliminates damage to the substrate and poor coating characteristics associated with powder plasma thermal spraying techniques (1:44-4:5).

Because both Palazzolo and Alkhimov teach the spray application of powders metals and/or alloys to substrates, and because Alkhimov teaches that the gas-dynamic cold spraying process is superior to powder plasma thermal spraying, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the process of Palazzolo so as to deposit the lining material by the gas-dynamic cold spraying technique of Alkhimov. One of ordinary skill in the art would have been motivated to do so by the desire and expectation

of successfully depositing a lining of material of superior quality without damaging the cylinder bore surface.

Alkhimov teaches the use of a particularly-configured nozzle to form a supersonic jet of a predetermined profile by expanding the gas in the nozzle (8:63-66; 10:22-26; and Fig. 1). Brockmann teaches a means for forming a supersonic jet of gas-entrained particles, useful in cold spray processing, in which the jet is aerodynamically focused through a nozzle illustrated in the figures. Brockmann teaches that such a nozzle is superior to a simple expansion nozzle because it results in a more focused, accurate beam of particles (1:10-50; 2:40-50; and 3:56-7:58). Because Brockmann teaches the superiority of the aerodynamically focusing nozzle to the expansion nozzle of Alkhimov, it would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov in order to substitute, for the expansion nozzle of Alkhimov, the aerodynamically focusing nozzle of Brockmann. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully forming a more focused, accurate supersonic jet of particles in the cold spraying process.

Shepard teaches a process similar to that of Palazzolo in which a lining material is applied to an aluminum cylinder bore by thermal spraying (c. 6, Example). The spray nozzle is advanced co-axially into the cylinder, and the nozzle sprays at an angle of approximately 40° with respect to the cylinder bore (c. 6, Example). The desired thickness may be applied in more than one pass (c. 6, Example). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the process of Palazzolo in view of Alkhimov and Brockmann so as to apply the lining material according to the process of Shepard described

above. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully coating the cylinder with the lining material.

The nozzle angle of 40° taught by Shepard falls within the claimed range of 30° plus or minus 15°. It is the examiner's position that, advancing the nozzle co-axially into the cylinder reads on having up-and-down relative movement with the engine block. Further, it is the examiner's position that Shepard's teaching of co-axially positioning the nozzle reads on the nozzle's being positioned along a longitudinal center axis of said cylinder. Finally, it is the examiner's position that modifications necessary to the apparatus of Alkhimov in view of Brockmann, such as those required to angle the nozzle to spray at approximately 40°, would have been well-within the level of skill of one of ordinary skill in the art.

Marantz teaches a process similar to that of Palazzolo in which a lining material is applied to a cylinder bore by thermal spraying (1:66-2:17). As illustrated best in Fig. 5, a plurality of cylinders (in Fig. 5, 4 cylinders) are coated simultaneously by spraying from nozzles having coaxial, reciprocating, unified, up-and-down movement with respect to the engine block. As is readily apparent, such an arrangement is significantly more efficient when compared to the one-cylinder-at-a-time coating process of Palazzolo. Consequently, it would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov, Brockmann, and Shepard so as to coat a plurality of cylinder bores simultaneously by spraying from nozzles having coaxial, reciprocating, unified, up-and-down movement with respect to the engine block, as taught by Marantz. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of improving the efficiency of the coating process by coating a plurality of cylinders at once, as opposed to one cylinder at a time.

The examiner notes that Shepard teaches that the cylinder bore is rotated while the liner material is applied from the nozzle. Obviously, rotation of the cylinder bores (and, by extension, the engine block) would be quite impossible where a plurality of nozzles are inserted into a plurality of bores simultaneously. Marantz teaches that common prior art processes for lining cylinder bores involve either rotation of the bores or rotation of the nozzles (see c. 1). Consequently, it would have been obvious to one of ordinary skill in the art to further modify the process of Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz so as to rotate the nozzles in the bores as opposed to the bores around the nozzles. One of ordinary skill would have recognized, from the teaching of Marantz, that both are obvious variations, one of the other, giving identical results: uniformly coating the inside of the cylinder bores.

With respect to claim 2, Palazzolo further teaches that the process coats the cylinder bore with a first and second lining material (abstract). The first lining material may be 95% bronze (4:50-54). Bronze is an alloy of copper. The second lining material may be ferritic stainless steel mixed with nickel-encapsulated boron nitride (5:8-15).

Palazzolo does not explicitly state that the second has a heat transfer resistance that is greater than the first material.

As noted above, Shepard teaches a process similar to that of Palazzolo in which a first lining material and a second lining material are thermal spray-applied to an aluminum cylinder bore (c. 6, Example). More specifically, Shepard teaches that, where a particular wear- and corrosion-resistance are desired, stainless steel may be the second lining material (5:23-27).

It would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz, so as to apply, as the second

lining material, stainless steel. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully depositing a wear- and corrosion-resistant lining material.

Applicant, at p. 6, l. 14-p.7, l. 15 of the specification, discloses that a suitable combination of first and second material layers, in which the second material layer has a higher heat transfer resistance than the first material layer, is copper alloy as the first material layer and stainless steel as the second material layer. Absent clear and convincing evidence to the contrary, it is the examiner's position that, in teaching the same material layers as those disclosed by applicant, Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz inherently teach coating the cylinder bore with two material layers, with the heat transfer resistance of the second material layer being greater than that of the first material layer.

With respect to claim 3, Palazzolo further teaches that the process coats the cylinder bore with a first and a second lining material (abstract). The first lining material may be 95% bronze (4:50 – 54). Bronze is an alloy of copper. The second lining material is ferritic stainless steel mixed with nickel-encapsulated boron nitride (5:8 – 15).

Palazzolo does not explicitly state that the adhesion of the first material layer to the aluminum engine block is greater than that of the second material layer, or that the material hardness of the second material layer is greater than that of the first material layer.

Nevertheless, Palazzolo teaches that the first material layer is coated as a bond coat because of its metallurgical affinity for the substrate (4:50 – 54). It is the examiner's position that, in the process of Palazzolo, the first material layer inherently has a greater adhesion to the aluminum engine block as attested to by it's being used as a bond coat.

Further, bronze is a soft alloy, certainly softer than ferritic stainless steel mixed with nickel-encapsulated boron nitride. It is the examiner's position that Palazzolo also, therefore, teach that the material hardness of the second lining material is greater than that of the first.

In the alternative, Shepard teach a process similar to that of Palazzolo in which a first and second lining material are thermal spray-applied to an aluminum cylinder bore (c. 6, Example). More specifically, they teach that where a particular wear- and corrosion-resistance are desired, stainless steel may be the second lining material (5:23 – 27).

It would have been obvious to one of ordinary skill in the art to apply, as the second lining material, stainless steel. One of ordinary skill in the art would have been motivated to do so by the expectation of successfully depositing a wear- and corrosion-resistant lining material.

Applicant, at p. 6, l. 14-p.7, l. 15 of the specification, discloses that a suitable combination of first and second material layers, in which the first material layer has a greater adhesion to the aluminum engine block that the second material layer, and the second material layer has a greater material hardness than the first material layer, is a copper alloy as the first material layer and stainless steel as the second material layer. Absent clear and convincing evidence to the contrary, it is the examiner's position that, in teaching the same material layers as those disclosed by applicant, Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz inherently teach coating the cylinder bore with two material layers, with the adhesion of the first material layer to the aluminum engine block greater than the second material layer, and the material hardness of the second material layer greater than the first material layer.

With respect to claim 4, Palazzolo does not explicitly state that the adhesion of the first material layer to the aluminum engine block is greater than that of the second material layer, or

that the material hardness of the second material layer is greater than that of the first material layer.

Applicant, on p. 6, l. 14-p. 7, l. 15 of the specification, discloses that a suitable combination of first and second material layers, in which the first material layer has a greater adhesion to the aluminum engine block that the second material layer, and the second material layer has a greater material hardness than the first material layer, is a copper alloy as the first material layer and stainless steel as the second material layer. Absent clear and convincing evidence to the contrary, it is the examiner's position that, in teaching the same material layers as those disclosed by applicant, Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz inherently teach coating the cylinder bore with two material layers, with the adhesion of the first material layer to the aluminum engine block greater than the second material layer, and the material hardness of the second material layer greater than the first material layer.

With respect to claim 22, Alkhimov teaches that the particle size of the materials deposited is between about 1 and about 50 microns (abstract). This overlaps both ranges claimed by applicant. In the case where claimed ranges overlap or lie inside ranges disclosed by the prior art, a *prima facie* case of obviousness exists. Consequently, it would have been obvious to one of ordinary skill in the art to deposit the first and second material utilizing a material size for each between about 1 and 50 microns, as suggested by Alkhimov. The examiner notes that Brockmann also teaches particle sizes of between 1 and 100 microns (1:55).

8. **Claims 20, 21, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Palazzolo et al. (US 5,691,004 A) in view of Alkhimov et al. (US 5,302,414 A), Brockmann et al. (US 6,348,687 B1), Shepard (US 2,588,422 A), and Marantz et al. (US**

5,714,205 A), as applied to claim 1 above, in further view of Gorynin et al. (US 5,362,523 A).

With respect to claims 20 and 21, Palazzolo, Alkhimov, Brockmann, Shepard, and Marantz teach all the limitations of these claims described above, including coating a first material with a lower thermal resistance and wear resistance than a second material (see the rejections of claims 2-4).

None of the cited references teach initially coating the cylinder bore with a first material, then with a gradient of the first material and a second material, followed by the second material.

Gorynin teaches that stable interfaces between two materials having differences in their physical properties (specifically, thermal expansion coefficients) may be achieved by forming a compositional gradient of the materials (1:10-23). Specifically, thermal shock that leads to delamination or spalling of coating layers is avoided by coating a film that is initially 100% of a first material and grades through the thickness profile of the deposited layer to 100% of a second material (see Fig. 4). While Gorynin particularly suggests a metal/metal-oxide graded film, it is clear that such a gradient may be advantageously produced from two other materials with different physical properties, such as to metals or alloys.

In the rejection of claims 2-4 above, it was established that Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz, teach the deposition of first and second materials with different thermal resistance. Consequently, it would have been obvious to one of ordinary skill in the art to deposit a graded layer of first and second materials, as suggested by Gorynin. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of preventing delamination and spalling of the coating due to thermal shock.

The examiner notes that Gorynin teaches powder plasma spraying the first and second materials. Again, as noted above, Alkhimov teaches the advantages of gas-dynamic cold spraying over powder plasma thermal spraying. It is the examiner's position that modifications necessary to the apparatus of Alkhimov in view of Brockmann, such as those required to provide for controlled, metered mixing of the first and second materials during deposition, would have been well-within the level of skill of one of ordinary skill in the art.

With respect to claim 23, Alkhimov teaches that the particle size of the materials deposited is between about 1 and about 50 microns (abstract). This overlaps both ranges claimed by applicant. In the case where claimed ranges overlap or lie inside ranges disclosed by the prior art, a *prima facie* case of obviousness exists. Consequently, it would have been obvious to one of ordinary skill in the art to deposit the first and second material utilizing a material size for each between about 1 and 50 microns, as suggested by Alkhimov. The examiner notes that Brockmann also teaches particle sizes of between 1 and 100 microns (1:55).

9. **Claim 24 is rejected under 35 USC 103(a) as being unpatentable over Palazzolo et al. (US 5,691,004 A) in view of Alkhimov et al. (US 5,302,414 A), Brockmann et al. (US 6,348,687 B1), Shepard (US 2,588,422 A), Marantz et al. (US 5,714,205 A), and Gorynin et al. (US 5,362,523 A).**

Palazzolo teaches a process of lining a cylinder bore of an aluminum engine block in which the cylinder bore is sprayed with a lining material of various metals that are different from the material of various metals that are different from the material of the engine block (abstract). The lining material is applied by thermal spraying (abstract). This thermal spraying is carried-out by a powder plasma spray technique (c. 4, ll. 55-56).

Palazzolo does not teach that the lining is applied using an aerodynamically focused gas-dynamic cold spray; that the spray comes from nozzles having unified, up-and-down relative movement with the engine block; that the nozzles are at an angle of 30° plus or minus 15° with a surface the cylinder bores; or that the process includes initially coating the bores with a copper material, then coating the bores with a blend gradient of copper and a wear material, and then coating the bores with the wear material.

Alkhimov teaches a cold gas-dynamic spraying process for applying a coating to an article (abstract). This process directs a jet of powder of a metal, alloy, or a mechanical mixture of the a metal and an alloy, against an article to deposit the coating (abstract). Alkhimov teaches that this cold gas-dynamic spraying process eliminates damage to the substrate and poor coating characteristics associated with powder plasma thermal spraying techniques (1:44-4:5). Because both Palazzolo and Alkhimov teach the spray application of powders of metals and/or alloys to substrates, and because Alkhimov teaches that the cold gas-dynamic spraying process is superior to powder plasma thermal spraying, it would have been obvious to one of ordinary skill, at the time the invention was made, to modify the process of Palazzolo so as to deposit the lining material by the cold gas-dynamic spraying technique of Alkhimov. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully depositing a lining material of superior quality without damaging the cylinder bore surface.

Alkhimov teaches the use of a particularly-configured nozzle to form a supersonic jet of a predetermined profile by expanding the gas in the nozzle (8:63-66; 10:22-26; and Fig. 1). Brockmann teaches a means for forming a supersonic jet of gas-entrained particles, useful in cold spray processing, in which the jet is aerodynamically focused through a nozzle illustrated in

the figures. Brockmann teaches that such a nozzle is superior to a simple expansion nozzle because it results in a more focused, accurate beam of particles (1:10-50; 2:40-50; and 3:56-7:58). Because Brockmann teaches the superiority of the aerodynamically focusing nozzle to the expansion nozzle of Alkhimov, it would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov in order to substitute, for the expansion nozzle of Alkhimov, the aerodynamically focusing nozzle of Brockmann. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully forming a more focused, accurate supersonic jet of particles in the cold spraying process.

Shepard teaches a process similar to that of Palazzolo in which a lining material is applied to an aluminum cylinder bore by thermal spraying (c. 6, Example). The spray nozzle is advanced co-axially into the cylinder, and the nozzle sprays at an angle of approximately 40° with respect to the cylinder bore (c. 6, Example). The desired thickness may be applied in more than one pass (c. 6, Example). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the process of Palazzolo in view of Alkhimov and Brockmann so as to apply the lining material according to the process of Shepard described above. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully coating the cylinder with the lining material.

The nozzle angle of 40° taught by Shepard falls within the claimed range of 30° plus or minus 15°. It is the examiner's position that, advancing the nozzle co-axially into the cylinder reads on having up-and-down relative movement with the engine block. Further, it is the examiner's position that Shepard's teaching of co-axially positioning the nozzle reads on the nozzle's being positioned along a longitudinal center axis of said cylinder. Finally, it is the

examiner's position that modifications necessary to the apparatus of Alkhimov in view of Brockmann, such as those required to angle the nozzle to spray at approximately 40°, would have been well-within the level of skill of one of ordinary skill in the art.

Marantz teaches a process similar to that of Palazzolo in which a lining material is applied to a cylinder bore by thermal spraying (1:66-2:17). As illustrated best in Fig. 5, a plurality of cylinders (in Fig. 5, 4 cylinders) are coated simultaneously by spraying from nozzles having coaxial, reciprocating, unified, up-and-down movement with respect to the engine block. As is readily apparent, such an arrangement is significantly more efficient when compared to the one-cylinder-at-a-time coating process of Palazzolo. Consequently, it would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov, Brockmann, and Shepard so as to coat a plurality of cylinder bores simultaneously by spraying from nozzles having coaxial, reciprocating, unified, up-and-down movement with respect to the engine block, as taught by Marantz. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of improving the efficiency of the coating process by coating a plurality of cylinders at once, as opposed to one cylinder at a time.

Palazzolo further teaches that the process coats the cylinder bore with a first and second lining material (abstract). The first lining material may be 95% bronze (4:50-54). Bronze is an alloy of copper.

As noted above, Shepard teaches a process similar to that of Palazzolo in which a first lining material and a second lining material are thermal spray-applied to an aluminum cylinder bore (c. 6, Example). More specifically, Shepard teaches that, where a particular wear- and corrosion-resistance are desired, stainless steel may be the second lining material (c. 5, ll. 23-27).

It would have been obvious to one of ordinary skill in the art to modify the process of Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz, so as to apply, as the second lining material, stainless steel. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of successfully depositing a wear- and corrosion-resistant lining material.

Gorynin teaches that stable interfaces between two materials having differences in their physical properties (specifically, thermal expansion coefficients) may be achieved by forming a compositional gradient of the materials (1:10-23). Specifically, thermal shock that leads to delamination or spalling of coating layers is avoided by coating a film that is initially 100% of a first material and grades through the thickness profile of the deposited layer to 100% of a second material (see Fig. 4). While Gorynin particularly suggests a metal/metal-oxide graded film, it is clear that such a gradient may be advantageously produced from two other materials with different physical properties, such as to metals or alloys.

In the rejection of claims 2-4 above, it was established that Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz, teach the deposition of first and second materials with different thermal resistance. Consequently, it would have been obvious to one of ordinary skill in the art to deposit a graded layer of copper and a wear-resistant material (specifically nickel-encapsulated cubic boron nitride or stainless steel), as suggested by Gorynin. One of ordinary skill in the art would have been motivated to do so by the desire and expectation of preventing delamination and spalling of the coating due to thermal shock.

The examiner notes that Gorynin teaches powder plasma spraying the first and second materials. Again, as noted above, Alkhimov teaches the advantages of gas-dynamic cold

spraying over powder plasma thermal spraying. It is the examiner's position that modifications necessary to the apparatus of Alkhimov in view of Brockmann, such as those required to provide for controlled, metered mixing of the first and second materials during deposition, would have been well-within the level of skill of one of ordinary skill in the art.

The examiner notes that Shepard teaches that the cylinder bore is rotated while the liner material is applied from the nozzle. Obviously, rotation of the cylinder bores (and, by extension, the engine block) would be quite impossible where a plurality of nozzles are inserted into a plurality of bores simultaneously. Marantz teaches that common prior art processes for lining cylinder bores involve either rotation of the bores or rotation of the nozzles (see c. 1). Consequently, it would have been obvious to one of ordinary skill in the art to further modify the process of Palazzolo in view of Alkhimov, Brockmann, Shepard, and Marantz so as to rotate the nozzles in the bores as opposed to the bores around the nozzles. One of ordinary skill would have recognized, from the teaching of Marantz, that both are obvious variations, one of the other, giving identical results: uniformly coating the inside of the cylinder bores.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William P. Fletcher III whose telephone number is (571) 272-1419. The examiner can normally be reached on Monday through Friday, 9 AM to 5 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive P. Beck can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

WPF 5/7/2004
William P. Fletcher III
Examiner
Art Unit 1762

SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700